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Agricultural Memorandum No. 250

Dates of Return to Soil Moisture Capacity

by L.P. Smith

The estimated date of return to soil capacity in the autumn depends on the balance between transpiration and rainfall. It is essential to estimate the actual soil moisture deficit in the summer and this depends on the crop and the soil.

Grass is the dominant form of ground cover; for this crop a moisture extraction model can be devised as follows:-

Actual transpiration equal to the potential with a potential soil moisture deficit of 2 in. or less
- half-potential with a potential deficit between 2 and 6 inches
- quarter-potential with a potential between 6 and 10 inches,

thus giving a maximum actual deficit of 5 inches.

With cereal crops this maximum may be greater, but they are harvested relatively early and the fallow ground which follows will lose less water by evaporation.

With other annual crops there may be a reduced transpiration in the early stages but the deeper roots of sugar-beet and potatoes may be more efficient extractors of water in the later stages than the relatively shallow roots of grass.

In general the model for grass may be accepted, especially as a greater source of error can lie in the assumption that all incoming rainfall percolates into the soil. There must be some surface run-off in severe storms especially on sloping ground, but it is impossible to estimate the amount.

The chosen time scale of the return to capacity was in 10 day units, namely 1 for September 5th, 2 for September 15th and so on. The calculations were carried out for 82 stations for the years 1940-1959.

The results are shown in Appendix 1, divided into 5 regions, North, Midlands, South West, South East and East. These tables give, for each station, the earliest date, the 25% early date (5 occasions in 20 on or before), the mean date, the 25% late date (5 occasions in 20 on or after), and the latest date.

There is a high correlation between these dates and the average annual rainfall and the equations for the regressions are given in Appendix 2. The mean errors are of the order of 5 days, which is reasonable when no account has been taken of the variations in potential transpiration from place to place, and it is accepted that the 20 year sample is inadequate to eliminate chance rainfall during the summer in the form of heavy local showers.

Any comments or suggestions on this paper should be sent to the Author.

Meteorological Office
Bracknell, Berks.
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Appendix 1

NORTH

	Earliest	25% in or before	Mean	25% in or after	Latest	Mean Annual Rainfall (in.)
Ambleside	Not at all	Early - June	July 17	Early - September	Early - October	74.4
Bolton	Late - May	Early - August	Aug. 20	Late - September	Early - November	56.4
Bellingham	Early - June	Mid - August	Sept. 17	Late - October	Early - December	34.7
Carlisle	Late - June	Late - August	Sept. 19	Mid - October	Mid - December	32.1
Morecambe	Mid - July	Late - August	Sept. 22	Late - October	Mid - November	38.4
Manchester	Late - June	Late - August	Sept. 25	Mid - November	Early - December	33.8
Newton Rigg	Mid - August	Late - August	Sept. 25	Mid - October	Early - December	34.9
Ilkley	Early - August	Late - August	Sept. 27	Early - November	Early - December	37.7
Blackpool	Early - August	Early - September	Oct. 6	Mid - November	Mid - December	35.1
Ampleforth	Late - July	Late - August	Oct. 17	Early - December	Late - December	30.0
Cockle Park	Mid - July	Early - September	Oct. 17	Late - November	Late - December	28.7
Berwick	Mid - August	Mid - September	Oct. 27	Early - December	Mid - January	23.3
Houghall	Late - August	Mid - September	Oct. 28	Late - November	Mid - January	27.9
Wakefield	Mid - August	Early - October	Nov. 6	Mid - December	Early - January	26.4
Tynemouth	Early - September	Early - October	Nov. 6	Mid - December	Late - December	25.9
Driffield	Late - August	Late - September	Nov. 7	Late - December	Early - January	26.0
Askham Bryan	Mid - August	Early - October	Nov. 10	Mid - December	Mid - January	26.0
Mansfield	Late - August	Mid - October	Nov. 11	Late - December	Mid - January	27.5
Hull	Late - August	Late - October	Nov. 17	Late - December	Late - January	25.4
Finningley	Late - September	Mid - November	Dec. 12	Mid - January	Early - February	22.3

MIDLANDS

	Earliest	25% in or before	Mean	25% in or after	Latest	Mean Annual Rainfall (in.)
Hanley	Early - June	Late - August	Oct. 5	Mid - November	Early - December	33.0
Delamere	Mid - July	Early - September	Oct. 9	Mid - November	Early - December	32.9
Birmingham	Mid - July	Mid - September	Oct. 14	Mid - November	Late - December	30.7
Belper	Late - August	Late - September	Oct. 16	Early - November	Late - December	28.8
Walsall	Early - July	Mid - September	Oct. 19	Late - November	Late - December	29.3
Leicester	Early - August	Late - September	Oct. 25	Mid - November	Mid - January	26.4
Gt. Missenden	Mid - August	Mid - October	Oct. 29	Late - November	Early - January	30.5
Chipping Norton	Early - September	Late - September	Nov. 4	Early - December	Mid - January	29.1
Towcester	Mid - August	Early - October	Nov. 6	Mid - December	Mid - January	26.6
Worcester	Late - August	Late - October	Nov. 13	Early - December	Early - February	25.3
Ross on Wye	Mid - September	Late - October	Nov. 15	Early - December	Early - January	27.9
Cheltenham	Mid - September	Mid - October	Nov. 15	Mid - December	Late - January	27.3
Oxford	Late - September	Late - October	Nov. 15	Mid - December	Mid - January	25.7
Shrewsbury	Late - August	Late - October	Nov. 14	Mid - December	Early - January	25.7
Sutton Bonington	Mid - September	Early - October	Nov. 18	Late - December	Mid - January	23.0
Kettering	Late - June	Early - November	Nov. 19	Late - December	Late - January	24.4
Leamington Spa	Late - August	Mid - October	Nov. 19	Mid - December	Early - February	24.6
Newport Pagnell	Mid - October	Early - November	Nov. 25	Late - December	Mid - February	24.3
Ketton	Late - September	Late - October	Nov. 27	Early - January	Late - February	23.7
Cranwell	Mid - October	Early - November	Dec. 6	Early - January	Early - February	23.5

SOUTHWEST

	Earliest	25% in or before	Mean	25% in or after	Latest	Mean Annual Rainfall (in.)
St. Austell	Mid - May	Early - September	Sept. 14	Mid - October	Early - November	48.4
Hartland Pt.	Early - August	Late - August	Oct. 7	Early - November	Early - December	36.3
Plymouth	Mid - August	Mid - September	Oct. 11	Mid - November	Late - November	37.8
Bristol	Early - August	Mid - September	Oct. 16	Mid - November	Late - December	32.2
Leckford	Late - August	Late - September	Oct. 20	Early - November	Late - December	31.6
Marlborough	Early - September	Late - September	Oct. 21	Late - November	Late - December	33.6
Newquay	Mid - August	Mid - October	Oct. 24	Mid - November	Mid - December	34.2
Lizard	Late - August	Late - September	Oct. 26	Mid - November	Mid - December	33.0
Blandford	Mid - September	Mid - October	Oct. 31	Mid - November	Early - January	34.2
Bournemouth	Late - September	Mid - October	Nov. 7	Early - December	Early - January	31.1
Boscombe Down	Late - August	Mid - October	Nov. 7	Early - December	Early - January	28.5
Cannington	Early - September	Mid - October	Nov. 8	Late - November	Early - January	29.9
Martock	Late - September	Late - October	Nov. 10	Early - December	Early - January	29.0
Exeter	Mid - September	Late - October	Nov. 15	Early - December	Early - January	31.9

SOUTHEAST

	Earliest	25% in or before	Mean	25% in or after	Latest	Mean Annual Rainfall (in.)
Wantage	Mid - September	Early - October	Nov. 1	Early - December	Early - January	28.8
Bodiam	Late - September	Early - October	Nov. 7	Mid - November	Early - January	31.7
Chichester	Early - September	Mid - October	Nov. 8	Early - December	Early - January	29.7
Wye	Late - August	Late - October	Nov. 10	Mid - December	Late - December	30.4
Rothamsted	Late - September	Late - October	Nov. 15	Mid - December	Early - January	28.4
S. Farnborough	Mid - September	Early - November	Nov. 20	Mid - December	Mid - January	26.9
E. Malling	Early - October	Early - November	Nov. 21	Mid - December	Early - January	26.9
Portsmouth	Mid - September	Early - November	Nov. 21	Mid - December	Mid - January	27.8
Wealdstone	Mid - September	Late - October	Nov. 23	Mid - December	Mid - January	27.5
Croydon	Mid - September	Early - November	Nov. 24	Mid - December	Mid - January	27.3
Reading	Late - September	Mid- November	Nov. 27	Mid - December	Mid - January	25.7
Kew	Late - September	Mid - November	Dec. 2	Early - January	Mid - February	24.0
Swanley	Mid - September	Mid - November	Dec. 6	Early - January	Late - January	23.0
Margate	Early - November	Mid - November	Dec. 15	Mid - January	Not at all	21.2

EAST

	Earliest	25% in or before	Mean	25% in or after	Latest	Mean Annual Rainfall (in.)
Swaffham	Early - October	Early - November	Nov. 27	Mid - December	Late - January	25.4
Spalding	Early - September	Early - November	Nov. 28	Late - December	Early - February	23.6
St. Ives	Late - August	Mid - November	Dec. 3	Early - January	Not at all	21.5
Cleethorpes	Mid - October	Mid - November	Dec. 3	Early - January	Mid - January	23.4
March	Mid - October	Mid - November	Dec. 4	Late - December	Late - February	23.1
Sprowston	Early - October	Mid - November	Dec. 4	Mid - December	Late - February	25.4
Saffron Walden	Early - September	Mid - November	Dec. 5	Late - December	Early - February	23.3
Cambridge	Late - September	Mid - November	Dec. 8	Early - January	Early - February	21.7
Sandy	Late - October	Mid - November	Dec. 9	Late - December	Not at all	22.8
Lowestoft	Mid - September	Mid - November	Dec. 9	Late - December	Mid - February	23.6
Kings Lynn	Late - October	Late - November	Dec. 10	Late - December	Early - February	22.6
Mildenhall	Late - September	Late - November	Dec. 15	Early - January	Not at all	21.6
Hatfield Peverel	Early - September	Late - November	Dec. 14	Early - January	Early - February	22.1
Felixstowe	Early - November	Late - November	Dec. 29	Mid - February	Not at all	20.9

Appendix 2

Equations for mean date of return to capacity

NORTH (30 in. or more annual rainfall)	11.27 - 0.23R
(30 in. or less)	30.51 - 0.87R
MIDLANDS	19.37 - 0.45R
SOUTH-WEST	16.21 - 0.31R
SOUTH-EAST	19.63 - 0.41R
EAST	21.60 - 0.48R

Equations for 25% early date of return to capacity — on or before

NORTH (30 in. or more)	3.5 - 0.1R
(30 in. or less)	27.8 - 0.9R
MIDLANDS	19.3 - 0.55R
SOUTH-WEST	12.1 - 0.25R
SOUTH-EAST	17.3 - 0.4R
EAST	17.3 - 0.4R

Equations for 25% late date of return to capacity — on or after

NORTH (30 in. or more)	13.9 - 0.2R
(30 in. or less)	24.5 - 0.5R
MIDLANDS	25.1 - 0.55R
SOUTH-WEST	16.8 - 0.25R
SOUTH-EAST	24.6 - 0.5R
EAST	35.6 - R

Results are expressed on the scale

1 ≡ September 5

4 ≡ October 5

7 ≡ November 5 and so on.